The invention relates to a shut-off device for protection against explosions in a pipe-line according to the pre-characterising clause of Claim 1.

A shut-off device for protection against explosions of this type is known for example from DE-A-198 21 756 . This specification discloses a slide valve plate for rapid shutting of pipe-lines, connected to a piston slidable within a cylinder and actuated by a pressure medium. The pressure medium is supplied from an external pressure reservoir to a working chamber in the cylinder via a closing valve. As a flame detected in the pipe-line propagates or a sudden pressure rise is suddenly detected, the closing valve opens, the piston is actuated and the slide valve plate movable transversely to the direction of flow is brought into the closed position within the shortest possible time, making it possible to prevent flame propagation and thus an explosion. Such shut-off devices for protection against explosion are used especially in chemical or foodstuffs plants but also in mining, cement, textile and wood-processing plants where dust explosions can occur, triggered off for example by a spark, friction, plant overheating etc. The disadvantage of these devices is as a rule that they take up a relatively great deal of space and their construction and assembly are complicated.

The task of the present invention is to create a shut-off device for protection against explosion of the type described at the beginning, which is simple to assemble, space-saving and can be shut within the shortest possible time.

This purpose is achieved in accordance with the invention by the shut-off device for protection against explosion which has the features of Claim 1.

Further embodiments of the shut-off device for protection against explosion in accordance with the invention form the subject of the related Claims.

Due to the fact that the cylinder is arranged within a pressure chamber enclosed by a housing which forms the pressure medium reservoir, there is no need for an external reservoir which would take up a lot of space, and a compact, space-saving shut-off device is created. In

addition, the communication route between the pressure chamber and the working chamber is short so that a very short closing time can be achieved.

The invention will now be explained in detail with reference to the drawings. The following is shown:

Figure 1: A front view and part section of a design of the shut-off device for protection against explosion in accordance with the invention, and

Figure 2: A longitudinal section through the shut-off device as in Figure 1.

Figures 1 and 2 show a shut-off device 1 for rapid shutting of a pipe-line. The pipe-line in which the shut-off device 1 is mounted transversely to the direction of flow A as in Figure 2 is not shown on the drawing. The shut-off device 1 in accordance with the invention offers a simple way of connecting the pipeline at two flange parts 2, 3 (Figure 2) forming a pipe passage 4, which are provided for this purpose with a number of bolt holes 5 (Figure 1) at the face for bolting-on the pipe-line flanges. The flange parts 2, 3 are bolted to a slide valve housing 7 by means of the bolts 6. The slide valve housing 7 has a gap 9 in which a slide plate 10 is slidably arranged transversely to the direction of flow A.

The two flange parts 2, 3 have passages 12, 13 as in Figure 2, with their diameter enlarged in the areas facing each other. Annular sealing elements 14, 15, each with a sealing ring 16, 17 fitted in the end face, are arranged in this area of the enlarged diameter of the through passages 12, 13. The two sealing rings 16, 17 sit sealingly at the slide valve plate 10 and form at the same time a guide for the movable slide valve plate 10. Therefore, they are made of a material with good sliding properties to ensure that the friction produced during the movement of the slide valve plate 10, which negatively affects the closing time, is as low as possible. The sealing elements 14, 15 in the enlarged part of the through passages 12, 13, can be fastened for example by means of carrier rings 18, 19 arranged at the periphery of the sealing elements 14, 15.

The slide valve plate 10 in the example of design shown here is in the form of what is referred to as a circular aperture valve plate which has a through aperture 20 opening up a pipe passage 4. The part of the slide valve plate 10 which shuts the pipe passage 4 as the slide valve plate 10 shifts, is designated by the numeral 21. In this area, the slide valve plate 10 is coupled on each side to a piston rod 25, 26 (Figure 1). The piston rods 25, 26, each connected to a piston 27, 28, are slidably guided through an end wall 31 of a housing 30 (the guide apertures are designated in Figure 1 by the numerals 32, 33) which is firmly connected to the valve housing 7. Both pistons 27, 28 are each slidably guided in a cylinder 35, 36, extending between the end wall 31, which has already been mentioned, and another end wall 37 of the housing 30 located opposite to it. The housing 30 has in addition a jacket 39 connecting the two end walls 31, 37 and enclosing the pressure chamber 40 which houses the two cylinders 35, 36. In accordance with the invention, the pressure chamber 40 forms a reservoir for a pressure medium, preferably air (or another gas) supplied from a pressure source at a mains pressure common in industrial systems by means which are not described in detail here, envisaged to actuate the piston and to provide the associated movement of the slide valve plate 10 into a position shutting the pipe passage 4.

To actuate the piston, the pressure medium is introduced from the pressure chamber 40 via a closing valve 45 into a respective working chamber 46, 47 of the two cylinders 35, 36 which are formed between the pistons 27, 28 and the end wall 37 of the housing 30 forming the cylinder head. A displacement chamber 48, 49 located on the other side of the respective piston 27, 28 communicates with a quick-venting valve 51 via the outlet port 50 arranged in the end wall 31 in the area of the respective cylinder 35, 36 on the side of the slide valve plate (only one of these outlet ports 50 with a venting valve 51 is shown on the drawing – see also Figure 2).

The closing valve 45 is fitted in the end wall 37 forming the cylinder head which also has a pressure chamber outlet port 55. Furthermore, a connecting duct 57 closable by a valve disk 56 of the closing valve 45, forking out and leading to the working chambers 46, 47 of the two

cylinders 35, 36 is made in the end wall 37. The pressure chamber outlet port 55 communicates with the connecting duct 57 when the closing valve 45 is made to open. The closing valve 45 is constructed and controlled essentially in the same way as the type disclosed in DE-A-198 21 756 and will not be described here in detail. The control elements 60 available for controlling the movement of the piston or the slide valve plate and a part of the closing valve 45 are arranged on the end wall 37 outside the housing 30 and encapsulated by a cap 61 which can be placed over the housing 30, to protect the control elements 60 from dust contamination and thus the resultant possible risk of explosion.

An end piece 70 (the bolts are designated by the numeral 71 in Figure 2) with a recess 72 adjoining the gap 9 in the housing 7, in which an abutment strip 73 extending over the width of the slide valve plate is guided in its movement in the direction of the slide valve plate 10, is fixed to the slide valve housing 7, at its end facing away from the housing 30. Two or more elastomer parts 74, for example pieces of silicone cord, are loosely placed with the existing gaps 75, between the abutment strip 73 and the end piece 70. The abutment strip 73 is made resistant to the impact produced by the slide valve plate 10 moving into the closed position, optimum damping of the impact being provided by the compressible elastomer parts 74 and the gaps 75 offering a possibility of deflection. The slide valve plate 10 does not need to be widened in the impact area which would otherwise increase its weight to disadvantage. The elastomer parts 74 which offer the advantage of multiple use are very easy to replace when it is eventually necessary to do so. The elastomer parts 74 are also available as a finished product.

The shut-off device is compact and space-saving as well as simple to assemble and economic thanks to an arrangement of the cylinders 35, 36 in accordance with the invention in a pressure chamber 40 enclosed by a housing 30, forming a reservoir for the pressure medium. In addition, an especially short shutting time is achieved thanks to the direct arrangement of the pressure chamber outlet port 55 at the connecting duct 57 leading to the working chamber 46, 47.

It would be quite possible to accommodate in the pressure chamber 40, which forms the reservoir for the pressure medium, a single piston/cylinder unit co-acting with the slide valve plate 10 in place of the two adjacent piston/cylinder units, making the connecting route between the pressure chamber and the working chamber possibly even shorter because the branch at the connecting duct 57 would be eliminated and the latter could terminate directly in the one working chamber. Using two piston/cylinder units with two piston rods 25, 26 located on the side of the slide valve plate 10 is of advantage particularly when using a valve plate with a circular aperture because the area 21' which is rear-most in relation to the closing direction of the part 21 closing the pipe passage 4 is offset in relation to the fixing point of the piston rods 25, 26 and can even protrude into a recess 31' in the end wall 31 of the housing 30 on the side of the valve plate, thereby further shortening the total length of the shutting off device 1 and of the closing time. In addition, only a smaller weight needs to be set in motion when two smaller pistons are used, and the transmission of forces to the slide valve plate 10 is more favourable.

The slide valve plate 10 in the valve housing 7 is guided by the sealing rings 16, 17 fitted to the flange parts 2, 3 and also by plastic or coated metal guides 8 or the like on the side, in the lower part of the valve housing. By using these guides, the friction at the slide valve plate can be kept low, allowing the pipe passage 4 to be shut at a faster speed. In addition, the sealing rings 16, 17 in the flange parts 2, 3 which are boltable to the slide valve housing 7 can be easily replaced without having to dismantle the valve housing 7.

The invention is sufficiently well explained on the basis of one example of design. Of course, it could be designed in a different way. For example, two or more closing valves in adjacent locations could also be arranged in place of one closing valve 45.